

Winter Mortality in the Green Anole, *Anolis carolinensis*
(Lacertilia: Polychridae)

Jane K. Distler
Michael E. Dorcas
J. Whitfield Gibbons
Karen L. Kandl
Savannah River Ecology Laboratory
Drawer E
Aiken, South Carolina 29802

and

Kevin R. Russell
Department of Forest Resources
Clemson University
Clemson, South Carolina 29634-1003

ABSTRACT- Winter behaviors of lizards are poorly documented. Most available information pertains to the formation of aggregations to escape freezing temperatures. During cold weather, lizards may seek shelter under bark, felled trees, or rotting stumps. However, such refugia may not provide adequate protection during abnormally cold conditions. We discovered the remains of 12 adult green anoles (*Anolis carolinensis*) within a Carolina bay located on International Paper Timber Company land in Marion County, South Carolina. The anoles presumably were killed by severe winter temperatures during the winter of 1996.

The winter behaviors of lizards have been poorly documented (Neill 1948, Weintraub 1968, Vitt 1974). Consequently, available information pertains only to the formation of winter aggregations, apparently to escape freezing temperatures. Several species of lizards are known to form these aggregations. Both Hamilton (1948) and Neill (1948) described the occurrence of five-lined skinks (*Eumeces fasciatus*) within felled trees and rotted logs and stumps. Worthington and Sabath (1966) documented winter aggregations of tree lizards (*Urosaurus ornatus*) within limestone outcroppings in Texas, and Weintraub (1968) described aggregations of over 37 individual granite spiny lizards (*Sceloporus*

orcutti) in rock crevices in California. Green anoles (*Anolis carolinensis*) have been reported to seek shelter, both individually and in aggregations, underneath felled trees and rotted stumps (Hamilton 1948, Neill 1948).

During severe cold winter spells, otherwise adequate habitat may not provide suitable refugia for winter protection. Lacking protection, lizards may die from freezing temperatures inside their chosen refugia. Such deaths have been documented. Worthington and Sabath (1966) found skeletal remains of over sixteen tree lizards in limestone fragments in Texas. Vitt (1974) found thirteen dead tree lizards and one banded sand snake (*Chilomeniscus cinctus*) within a rotted stump in Arizona. Weintraub (1968) found the remains of granite spiny lizards of all age classes within granite crevices.

Fig. 1. Remains of green anoles (*Anolis carolinensis*) on a Cypress stump within a Carolina bay in the PeeDee River region, South Carolina.



During a herpetofaunal survey on 15 March 1996, we discovered the remains of twelve adult green anoles within a Carolina bay located between the Great Pee Dee and Little Pee Dee Rivers in northeastern South Carolina (Fig. 1). The 1.2-ha Carolina bay was dominated by bald cypress (*Taxodium distichum*) and was semipermanently flooded. The bay was surrounded by a one-year-old clear-cut. The anoles were found beneath the bark of a rotted bald cypress that was still upright within the bay. Eleven of the specimens appeared to have been mummified. One anole skeleton was also found along side the other anoles, indicating that at least one individual had died previously in the same location. All twelve specimens were on the southeast side of the tree.

Although there are several possible explanations for the anole deaths (e.g., disease), the anoles were most likely killed by freezing temperatures during winter, which leads to the question of "why did the anoles choose this particular site to overwinter?" One possibility is that there was no other suitable habitat available (Worthington and Sabath 1966, Weintraub 1968, Vitt 1974). However, the presence of living anoles in the immediate vicinity (within the same Carolina bay) indicates at least some lizards were able to find suitable overwintering habitat. Long-distance migration is unlikely to account for the presence of living anoles, because they were found within the bay shortly after the uncharacteristically cold weather.

Another, more likely explanation is that, under normal circumstances, this particular site would have provided suitable overwintering habitat. However, below-normal temperatures during winter 1995-1996 might have been too extreme for lizard survival in this particular location. According to the South Carolina State Climatology Office, average temperatures during winter 1995-1996 were lower than the average of all temperatures for the Pee Dee region from 1948 to 1996. More importantly, December 1995 and January 1996 each had more than 20 consecutive days with low temperatures below 0 C; February 1996 experienced 15 days below 0 C. Prolonged low temperatures are infrequent in most years in this region. January and February 1996 rank highest in the number of days since 1988 when temperatures fell below the deep freeze point (-2 C). We hypothesize that some wintering habitat, which was suitable in years with normal winter temperatures, might have proven to be unsuitable during the particularly cold winter of 1995-1996. In addition, *Anolis carolinensis* commonly seeks relatively superficial cover (Palmer and Braswell 1995), thus exposing itself to harsher temperatures than other species that select areas with greater protection. As a result, winter temperatures are most likely a controlling factor in the northern distribution of *Anolis carolinensis*.

ACKNOWLEDGMENTS- We would like to thank A. Braswell and B. Wigley for providing comments that substantially improved the manuscript. We thank International Paper for providing access to the study area and the funding for this pro-

ject. Other funding agencies include the National Fish and Wildlife Foundation and the National Council of the Paper Industry for Air and Stream Improvement (NCASI). Manuscript preparation was supported by financial assistance award # DE-FC09-96SR18546 from the U.S. Department of Energy to the University of Georgia Research Foundation.

LITERATURE CITED

- Hamilton, W. J. 1948. Hibernation site of the lizards *Eumeces* and *Anolis* in Louisiana. *Copeia* 3:211.
- Neill, W. T. 1948. Hibernation of amphibians and reptiles in Richmond County, Georgia. *Herpetologica* 4:107-114.
- Palmer, W. M., and A. L. Braswell. 1995. Reptiles of North Carolina. The University of North Carolina Press. Chapel Hill, North Carolina.
- Vitt, L. J. 1974. Winter aggregations, size classes, and relative tail breaks in the tree lizard, *Urosaurus ornatus* (Sauria: Iguanidae). *Herpetologica* 30:182-183.
- Weintraub, J. D. 1968. Winter behavior of the granite spiny lizard, *Sceloporus orcutti* Stejneger. *Copeia* 4:708-712.
- Worthington, R. D., and M. D. Sabath. 1966. Winter aggregations of the lizard *Urosaurus ornatus ornatus* (Baird and Girard) in Texas. *Herpetologica* 22:94-96.

Received 15 November 1996

Accepted 18 March 1997